



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/798,331

03/12/2004

Stanislav Kadlec

635.43483X00

6134

20457

7590

10/14/2008

ANTONELLI, TERRY, STOUT & KRAUS, LLP

1300 NORTH SEVENTEENTH STREET

SUITE 1800

ARLINGTON, VA 22209-3873

EXAMINER

BAND, MICHAEL A

ART UNIT

PAPER NUMBER

1795

MAIL DATE

DELIVERY MODE

10/14/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/798,331

Applicant(s)

KADLEC ET AL.

Examiner

MICHAEL BAND

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 August 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 36, 49-57, 62, 63, 67-78 and 96-98 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 36, 49-57, 62, 63, 67-78 and 96-98 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 8/28/2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/28/2008 has been entered.

Claim Objections

2. Claim 36 is objected to because of the following informalities: Section B of claim 1 reads a second magnet *subsarrangement*. Appropriate correction is required.

Claim Rejections - 35 USC § 102

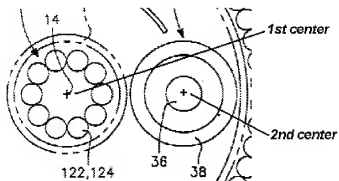
3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 36 and 96-97 are rejected under 35 U.S.C. 102(e) as being anticipated by Wang et al (US Patent No. 6,837,975).

With respect to claims 36 and 96-97, Wang et al discloses a magnetron system [70] having an annular (i.e. circular) sputter target [12] facing a substrate [24] and a roof magnetron [34] on the opposite side of said sputter target [12] (abstract; fig. 4), where fig. 4 depicts said sputter target [12] circular about a first center [14]. Fig. 4 further depicts the roof magnetron [34] having a first magnet subarrangement [36] with a second center, a second magnet subarrangement [38] with said second center, and a third magnet subarrangement [132], [134] with the first center [14], where the magnetic polarities of said first magnet subarrangement and said second magnet subarrangement are opposite. Fig. 6 depicts the first magnet subarrangement [36], the second magnet subarrangement [38], and third magnet subarrangement [132], [134] all as circular, with said third magnet subarrangement [132], [134] being capable of rotating(i.e. sweeping) along the sputter target [12] as evidenced by the outer arrow. Fig. 1 depicts magnetic fields emitted from the first magnet subarrangement [36] and the second magnet subarrangement [38], where the magnetic fields shown are larger for said second magnet arrangement [38] than for said first magnet subarrangement [36], with the magnetic field of a third magnet subarrangement [32] superimposed on the other magnetic fields. The cropped figure below of fig. 6 serves to further clarify the second center.



5. Claims 49-51, 57, 62-63, 67-68, 74-78, and 98, are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Wang et al (US Patent No. 6,837,975).

With respect to claims 49-51, 57, 62-63, and 98, Wang et al discloses a magnetron system [70] having an annular (i.e. circular) sputter target [12] facing a substrate [24] and a roof magnetron [34] on the opposite side of said sputter target [12] (abstract; fig. 4), where fig. 4 depicts said sputter target [12] circular about a first center [14]. Fig. 4 further depicts a roof magnetron [34] having a magnetic field generated by an inner pole magnet [36] and an outer pole magnet [38], with an asymmetric and unbalanced (see fig. 6) sidewall magnet ring [130] having upper magnets [132] and lower magnets [134]. Fig. 1 depicts the roof magnetron [34] having a closed loop [40] that emits from the outer pole magnet [38] to the inner pole magnet [36] and is parallel to the sputter target [12] surface, with said inner pole magnet [36] being a second center. Fig. 1 also depicts a sidewall magnet [32] emitting a long range magnetic field [48] and a second magnetic field [46] about the center axis [14]. Despite fig. 4 not

Art Unit: 1795

depicting a magnetic field for the asymmetric sidewall magnet [130], it is either inherent or obvious that since said asymmetric sidewall magnet [130] of fig. 4 is similar in design to the sidewall magnet [32] of fig. 1, the magnetic fields for the two sidewall magnets [130], [32] would be similar. Wang et al further discusses a plasma being initiated by flowing argon into the magnetron system [70] and igniting it into a plasma (col. 5, lines 53-55), where fig. 4 depicts the argon gas flow in the vicinity of the substrate [24], thus the plasma treats said substrate [24]. Wang et al also discusses the roof magnetron [34] creating a very strong magnetic field that creates a very high plasma density in a portion of a roof [20] and therefore the sputter target [12] (col. 4, lines 3-13). Fig. 6 depicts the roof magnetron [34] and asymmetric sidewall magnet [130] rotating (i.e. sweeping) around the center axis [14].

Comment [a1]: 102/103... ahhh!!!

It's OK to use here, but I don't think the analysis is complete as to why it would be obvious.

With respect to claims 67-68, Wang et al further depicts in fig. 4 a substrate (i.e. wafer) [24] supported on a pedestal. It is inherent that the apparatus be capable of providing more than one substrate. Fig. 6 depicts the roof magnetron [34] and asymmetric sidewall magnet [130] rotating (i.e. sweeping) around the center axis [14]. It is well known for a semiconductor wafer, discussed in Wang et al, to be circular and to be arranged on a circular pedestal.

With respect to claim 69, Wang et al further discloses electrically feeding said plasma by a pulsating supply signal (col. 5, lines 53-67; col. 6, lines 1-4).

Comment [a2]: not listed above

With respect to claims 74-75, Wang et al further discloses a chamber pressure of 10^{-8} Torr, with a pressure range of 0.1 to 5 milliTorr (col. 5, lines 49-52).

With respect to claims 76-77, Wang et al further discloses biasing a pedestal electrode [23] which holds the substrate [24] with an RF power from an RF bias supply [108], where a controller [110] controls the amount of RF power (col. 5, lines 60-67; col. 6, lines 1-4).

With respect to claim 78, Wang et al further discloses sputtering materials being titanium, tantalum, and copper (col. 1, lines 50-61), with copper specifically used for the apparatus (col. 5, lines 53-60).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al (US Patent No. 6,837,975) as applied to claim 49 above, and further in view of Wang (US Patent No. 6,352,629).

With respect to claims 52-53, the reference is cited as discussed for claim 49. However Wang et al is limited in that a specific magnetic field Gauss strength is not suggested.

Wang teaches a method for sputter coating a wafer (i.e. substrate) [24] in a vacuum chamber [12] via a high-density plasma (fig. 1; col. 4, lines 19-43). Depicted in fig. 1 is a surface of a target [16] and a wafer with a surface [24] opposite of the target

(col. 4, lines 28-29). Fig. 1 depicts a sidewall magnet [40] and a magnetron [36] that forms magnetic field $[B_m]$ as a closed loop with the direction towards the target surface, as indicated by the arrows, where the tangent line to the minimum peak of $[B_m]$ is parallel to the target surface, with said magnetron [36] having unillustrated motor and drive shaft aligned to a central axis [38] that rotates the back plate of the magnetron in a sweeping motion in relation to the central axis (fig. 1; col. 4, 44-48). Wang further discloses a component of the magnetic field $[B_m]$ parallel to said substrate surface and magnetic field $[B_m]$ having a strength in the range of about 10 gauss to 1000 gauss (col. 5, lines 60-65) and magnetic field $[B_c]$ having a strength in the range of about 15 gauss to 100 gauss (col. 7, lines 10-17). Wang cites the advantage of using these specified magnetic field strengths as leading to better guidance of ionized sputtered atoms.

It would have been obvious to one of ordinary skill in the art to incorporate the magnetic field strengths taught in Wang for the magnetic fields of Wang et al to gain the advantage of superior guidance of sputtered atoms from sputter target to substrate.

8. Claims 55-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al (US Patent No. 6,837,975) as applied to claim 1, respectively, above and in further view of Chiang et al (US Patent No 6,398,929).

With respect to claims 55-56, Wang et al further depicts in fig. 1 that a tunnel-like magnetron field pattern $[B_m]$ covers a percentage of the target surface. However Wang et al is limited in that while the tunnel-like magnetron field pattern covers a percentage of the target, a specific percentage is not suggested.

Chiang '929 teaches a similar apparatus in fig. 4 for sputtering a substrate with a magnetron [130] attached to a motor-driven drive shaft [142]. Chiang '929 also discusses how the magnetron [130] is rotated about the center [140] of the target [56] by a motor-driven shaft [142] to achieve full coverage (i.e. 100%) in sputtering of the target (col. 12, lines 9-13).

It would have been obvious to one of ordinary skill in the art to incorporate the full coverage (i.e. 100%) of Chiang '929 for the coverage percentage of Wang '629 since Wang '629 fails to disclose a specific coverage percentage.

9. Claims 70-73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al (US Patent No. 6,837,975) as applied to claim 69 above, and further in view of Chiang et al (USPGPub 2001/0050220).

With respect to claims 70 and 71, the reference is cited as discussed for claim 69. Wang et al is limited in that while a pulsating, and therefore a frequency, is discussed, the claimed range is not specified.

Chiang et al teaches sputtering on a substrate by ionized metal plasma deposition (abstract) utilizing a similar apparatus with a magnetron [106] above a substrate [110] with a vacuum pump [146] and shield [128] (fig. 1). Chiang et al also teaches an RF power source [134] that biases the substrate (p. 2, para 0021) where the positive and negative voltage portions are sequentially alternated to result in a series of target/coil sputtering steps resulting in a frequency of between about 1 kHz and 200 kHz (p. 3, para 0030). It is well known that an RF power source is a pulsating power source

as evidenced by fig. 2. Chiang et al lists the advantage of using this RF bias power as to influence the direction of ions in the chamber during processing (p. 1, para 0009).

It would have been obvious to one of ordinary skill in the art to use the bias RF power taught in Chiang et al for the power source of Wang et al in order to gain the advantage of influencing the direction of the ions during processing.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

With respect to claims 72 and 73, the reference is cited as discussed for claim 69. Wang et al further discloses power sources being pulsating, with it is well known that a pulsating power source has a duty cycle or ratio associated with it. However Wang et al is limited in that while it is inherent that a duty cycle or ratio is incorporated with the power source, a specific duty cycle or ratio is not specified.

Chiang et al further teaches a duty cycle associated with the frequency range discussed earlier. Chiang et al discusses a duty cycle between about 50% and about 90% (p. 3, para 0030), leading to a conclusion that the off-time must therefore be from about 50% and about 10%. Chiang et al lists the advantage of using this RF bias power, and therefore the duty cycle, as to influence the direction of ions in the chamber during processing (p. 1, para 0009).

It would have been obvious to one of ordinary skill in the art to use the duty cycle taught in Chiang et al for the duty cycle of Wang et al in order to gain the advantage of influencing the direction of the ions during processing.

It has been held that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" *a prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

Response to Arguments

10. Applicant's arguments, see p. 9-11, filed 8/28/2008, with respect to the rejection(s) of claim(s) 36, 49-54, 57-69, 74-88, and 90-95 under 102 and claim(s) 55-56, 70-73, and 89 under 103 have been fully considered and are persuasive.

Comment [a3]: need a why

Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Wang et al (US Patent No. 6,837,975), Wang (US Patent No. 6,352,629), and Chiang et al (USPGPub 2001/0050220).

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent Nos. 6,436,251; 6,444,104; 6,491,801.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Band whose telephone number is (571) 272-9815. The examiner can normally be reached on Mon-Fri, 8am-4pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1795

13. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. B./

Examiner, Art Unit 1795